

## CAAP Adaptation Actions- Draft Released 5/31/19

This chapter includes adaptation strategies that have been identified to improve the ability of Long Beach and its residents and businesses to adapt to the climate change and related impacts now and in the future. Actions are identified into four sectors:

- Extreme Heat
- Air Quality
- Drought
- Flooding

These adaptation actions were developed based on the 2018 Long Beach Climate Stressors Review (Appendix XX and found at: <http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7282>) and the Long Beach Climate Change Vulnerability Assessment Results (Appendix XX, found at: <http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7362>).

A range of factors were considered in the design and selection of the various actions, including:

- The projected timeframe and estimated likelihood of the vulnerability
- The importance and effectiveness of each action in increasing resilience
- Technical feasibility and City implementation capacity
- Public and stakeholder feedback throughout the CAAP development process

The City has placed a high priority on public engagement and input to identify and select actions. Major points of public emphasis to this point in the process include selecting actions that have strong, positive, and inclusive impacts on low-income and disadvantaged communities. As a result, a significant majority of the actions include implementation steps that will require the City to prioritize these actions in areas of highest need. Each action includes a description, implementation steps and responsibilities, potential performance metrics and co-benefits, and any anticipated equity benefits. These actions will be further refined for inclusion in the final CAAP so that the City and community have a clear roadmap to withstand rising temperatures, flooding associated with sea level rise and intense storm events, and drought among others.

**Extreme Heat, Air Quality, and Drought Adaptation Actions Summary**

#	Extreme Heat
EH-01	Increase presence of cool roofs and cool walls
EH-02	Increase presence of reflective and shade canopies
EH-03	Increase public access to water
EH-04	Develop mitigation plan for power outages related to extreme heat
EH-05	Expand implementation of the Urban Forest Management Plan
EH-06	Provide bus shelter amenities
EH-07	Expand accessibility of cooling centers
#	Air Quality
AQ-01	Incentivize installation of photocatalytic roofing tiles
AQ-02	Make Long Beach Airport a center for electric powered aircraft
AQ-03	Electrify local, small emitters
AQ-04	Electrify school buses
AQ-05	Increase monitoring of oil extraction and refining process
#	Drought
DRT-01	Implement additional water conservation programs
DRT-02	Develop additional water supplies or other actions as prescribed in the Urban Water Management Plan
DRT-03	Continue outreach and education related to water conservation
DRT-04	Encourage urban agriculture practices that promote drought resilience

**Sea Level Rise and Flooding Adaptation Strategies Summary**

#	Action Name
<b>Short-Term (to 2030)</b>	
<b>Governance</b>	
FLD-01	Establish floodplain ordinance
FLD-02	Incorporate sea level rise language into citywide plans, policies, and regulations
FLD-03	Establish a flood impacts monitoring program
FLD-04	Incorporate SLR and flooding adaptation into City lease negotiations
FLD-05	Upgrade the City's existing Stormwater Management Plan
<b>Informational</b>	
FLD-06	Conduct citywide beach stabilization study
FLD-07	Conduct studies of combined riverine/coastal flooding and increased precipitation impacts on watershed flooding
<b>Physical/Structural</b>	
FLD-08	Restore dunes
FLD-09	Inventory and flood-proof vulnerable sewer pump stations
<b>Medium-Term (2030 - 2050)</b>	
<b>Governance</b>	
FLD-10	Investigate sea level rise adaptation funding mechanisms and strategies
<b>Structural/Physical</b>	
FLD-11	Relocate/elevate critical infrastructure
FLD-12	Elevate riverine levees (as identified by FLD-07)
<b>Long-Term (2050 – 2100)</b>	
<b>Structural/Physical</b>	
FLD-13	Continue to nourish beaches
FLD-14	Construct living shoreline/berm
FLD-15	Elevate/extend curb
FLD-16	Retrofit/extend sea wall
FLD-17	Elevate streets/pathways
FLD-18	Retreat / realign parking lots
FLD-19	Extend/upgrade existing seawalls
<b>Informational</b>	

FLD-20	Investigate feasibility of managed retreat
FLD-21	Evaluate feasibility of storm surge barrier at Alamitos Bay

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### **EH-01: Increase presence of cool roofs and cool walls**

Increase the installation of cool roofs and cool walls to keep buildings and neighborhoods cooler.

**Scale of Action (Asset, Neighborhood, City Wide):** Citywide

**Implementation Lead:** Development Services

**Partners:** Department of Health and Human Services, Office of Sustainability, Southern California Edison (SCE)

**Timeline:** Short (0-3 years) and Medium (3-6 years)

#### **Potential Performance Metrics:**

- # of regulatory changes made
- # cool roofs installed
- # cool walls installed

#### **Co-benefits:**

- Improved air quality
- Increased thermal comfort
- Reduced energy use and costs

#### **Description:**

Cool roofs and cool walls reflect sunlight, effectively reducing the amount of the sun's energy that enters the building. This keeps homes and businesses cooler, reducing the amount of additional cooling that may be needed to keep internal air temperatures at a healthy level (particularly during heat waves). Reflective surfaces also lower temperatures in the surrounding neighborhood. While this provides broader public health and quality of life benefits, vulnerable populations such as the sick, the young, and the elderly and low-income and disadvantaged communities stand to benefit the most.

Cool roofs are required under the California Green Building Code, if the building is to achieve Tier 1 or 2 compliance. However, under Part 6 of the Energy Code, any building will get compliance credits against the baseline building if it has a cool roof. Both the City of Los Angeles and County of Los Angeles have made cool roofs mandatory for new and replaced residential roofs. Long Beach will pursue making a similar requirement.

Growing a vegetative layer (plants, shrubs, grasses, and/or trees) on a rooftop can also act as a cool roof, providing insulation to the building below. Due to seismic considerations these green roofs, which can be heavy due to thick layers of substrate material, can only be sited on steel-reinforced buildings, and are significantly more costly than cool roofs. As a result, cool roofs are generally accepted as a more cost-effective approach to reducing the heat island effect than green roofs but both options should be allowed and incentivized based on the local context. Despite this, green roofs can potentially offer important co-

benefits such as increased green space and local food production, which can be especially important in disadvantaged and low-income communities that lack access to both. It is expected that candidate buildings in these communities may not be able to support green roofs; however, the City will conduct a study to assess the feasibility of green roofs in these areas.

**Implementation Steps:**

- Determine parameters for proposed amendments to the building code
- Update the building code to mandate the installation of cool roofs on all new and retrofitted roofs
- Explore the feasibility of incentivizing green roofs on new buildings in park-poor and disadvantaged communities, especially those most vulnerable to extreme heat and/or poor air quality
- Conduct education and outreach to roofing companies that operate within the city

**Potential Cost Level:** TBD

**Equity Impacts:**

- Low income communities would benefit from the reduced energy costs resulting, if their buildings could be refurbished with cool roofs
- Pilot projects to showcase cool roof materials could prioritize low-income communities
- Curbing urban heat island will benefit the health of outdoor laborers and the homeless
- Green roofs in disadvantage communities could create new access to green spaces

## **EH-02: Increase presence of reflective streets, surfaces, and shade canopies**

Treat paved surfaces such as streets, parking lots, and playgrounds with reflective surfaces and install shade canopies to reduce urban heat.

**Scale of Action (Asset, Neighborhood, City Wide):** Citywide

**Implementation Lead:** Public Works

**Partners:** Long Beach City College, Cal State Long Beach, parking lot owners, Parks, Recreation & Marine, Long Beach Unified School District

**Timeline:** Short (0-3 years)

### **Potential Performance Metrics:**

- Regulatory/process changes to incentivize or mandate reflective surfaces
- # of square feet of pavement treated with “cool pavement”
- # of shade canopies installed

### **Co-benefits:**

- Increased lifespan for asphalt surfaces
- Improved air quality
- Energy cost savings and GHG reductions

### **Description:**

Roads that have been treated with a grey-colored water-based asphalt emulsion that reflects the sun’s rays instead of absorbing them (such as CoolSeal), have shown to be an average of 10 to 15 degrees cooler than roads with traditional, untreated blacktop. Whereas traditional asphalt reflects around 10% of solar radiation and absorbs and radiates the remaining 90% as heat, “cool pavement” reflects 35-50% of the sun’s rays. Pilot cool street projects in the City of Los Angeles and elsewhere in the world have been well-received. As long as the reflectivity of the cool street does not exceed 50%, glare has not proven to be an issue of concern.

Playgrounds and parking lots can similarly be treated with "cool pavement." Since hotter temperatures result in more ozone and smog formation, cool pavement also is an effective way to improve local air quality. Children are particularly vulnerable to respiratory disease due to poor air quality, and so targeting playgrounds for cool pavement application could deliver important public health benefits. Likewise, parking lots are a cost-effective location for cool pavement, since slow vehicle speeds mean that the reflective coating will have a longer durability on parking lots than they would on high-volume, high-speed streets that receive more wear-and-tear. The City will identify corridors in disadvantaged communities (CalEnviroScreen) that are most vulnerable to extreme heat and/or poor air quality to act as pilot projects as a precursor to rolling out cool streets on a larger scale.

Additionally, the City will identify priority areas for shade structures, especially in areas heavily exposed to sunlight, such as parking lots. Shade is a highly effective way of reducing temperatures and improving thermal comfort.

**Implementation Steps:**

- Establish priority corridors to pilot cool pavement application in disadvantaged communities most vulnerable to extreme heat and poor air quality
- Engage with partners to identify playgrounds and parking lots that would benefit from cool pavement and shade installations
- Identify and complete City code changes to incentivize or require the use of cool pavement on projects
- Identify and secure funds for capital improvements.

**Potential Cost Level:** TBD

**Equity Impacts:**

- Curbs urban heat island effect and smog formation, which reduces health risks for homeless, outdoor laborers and people who walk, bike, and take public transportation
- Cools entire neighborhoods, which saves money for residents by reducing their energy needs for cooling



### **EH-03: Increase public access to water**

Ensure that there are working water fountains or water refill stations in all public facilities, parks and beaches, and where feasible at other public amenities such as bus shelters.

**Scale of Action (Asset, Neighborhood, City Wide):** Citywide

**Implementation Lead:** Public Works

**Partners:** Long Beach Water, Long Beach Parks, Recreation and Marine, Long Beach Unified School District

**Timeline:** Medium (3-6 years)

#### **Potential Performance Metrics:**

- Number of new drinking fountains and water refill stations installed overall and in disadvantaged communities
- % of drinking fountains and water refill stations in good working order

#### **Co-benefits:**

- Staying hydrated reduces the risk of heat stroke and other physical ailments
- Drinking fountains reduce dependence on single-use plastic; which also reduces greenhouse gas emissions
- Reducing plastic trash helps keep public spaces clean, including our parks and beaches

#### **Description:**

Climate change will bring more days of extreme heat, which can lead to dehydration, heat related illness, injury, or death. Drinking fluids is crucial to staying healthy. Outdoor workers, the homeless and older adults often do not get enough fluids and risk becoming dehydrated and sick, especially during summer. As average temperatures and the number of extreme heat days and warm nights increase over the coming decades, accessible public water supply will become increasingly important.

Public water fountains offer access to free water and reduce waste. At parks, schools, public buildings, and other facilities, water fountains are a valuable public resource for improved public health. The City will identify locations and complete installations at City facilities and other partner agencies such as Long Beach Unified School District. The City of San Francisco recently installed 155 new fountains and has given away close to 50,000 stainless steel canteens to local students.

Drinking tap water and water from public fountains also has a strong positive impact on the health of our environment and our climate. From production to disposal, plastic bottles have lasting negative impacts. Manufacturing and recycling plastic bottles requires substantial energy and produces GHG emissions. Additionally, despite efforts to increase recycling rates, the vast majority of plastic bottles end up in landfills and the natural environment. Plastic remains in the environment eventually finding its way into

rivers, wetlands, and oceans where it has long-term negative impacts on ecosystems and organisms. By contrast, Long Beach Water Department delivers high-quality water at the tap or water fountain at a fraction of the cost (and carbon footprint) compared to bottled water, and offers home testing for anyone concerned about pipes in older buildings.

**Implementation Steps:**

- Survey the location of all public drinking fountains in the City of Long Beach – and further audit to see if the fountains are in a state of good repair
- Identify areas where water stations are missing and needed
- Identify those public facilities when fountain repairs or replacements are needed
- Work with Long Beach Unified School District to ensure that school fountains are in a state of good repair
- Work with WeTap to ensure that the smart phone app provides the coordinates of all public water fountains
- Support Long Beach Water Department efforts to spread awareness of its home testing program and steel water bottle give-aways

**Potential Cost Level:** TBD

**Equity Impacts:**

- Water fountains provide free water and reduce household costs
- Public water access is important during hot weather, especially in low-income and disadvantaged neighborhoods

**EH-04: Identify future vulnerability potential for power outages related to extreme heat and develop plans to prevent such outages**

Continue to partner with Southern California Edison to assess current grid vulnerabilities related to extreme heat to prevent future potential power outages due to worsening heat waves because of climate change.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Disaster Preparedness and Emergency Communications, Public Works

**Partners:** Office of Sustainability, Southern California Edison (SCE)

**Timeline:** Short (0-3 years)

**Potential Performance Metrics:**

- assessment of grid vulnerabilities
- Actions developed to prevent future power outages related to extreme heat

**Co-benefits:**

- Expansion of renewable energy capacity
- Measures adopted could also support grid stability in the face of other risks
- Reduced health risks of vulnerable and electricity-dependent populations

**Description:**

Extreme heat events cause people to increase their use of air conditioning to keep cool, which causes strain on the transmission lines and the electrical grid. Other factors such as the sagging of power lines in high heat events can cause issues as well. This means heat waves can cause power outages that could be inconvenient and even life threatening for the vulnerable residents of Long Beach. In July 2015, high temperatures may have been a factor in equipment failures that caused two power outages in downtown Long Beach that left thousands of residents and businesses without power for days. The power outage stranded people without medical devices, refrigeration, air conditioning or elevator service during a period of high temperatures. This was particularly challenging for seniors living in high-rise apartments (KPCC 2015). Since 2015, SCE has been involved in national efforts to accelerate the development of and investment in technologies, practices, and policies that will create a more resilient energy system. As a part of these efforts SCE analyzed its system using future climate models in order to understand better how to prepare for changes in its environment.

The City will continue to work with SCE to assess potential grid vulnerabilities due to worsening extreme heat and to develop and refine strategies and actions to prevent future power outages related to extreme heat.

Depending on the results of the assessment, actions will be identified and prioritized to reduce pressure on the grid and build Long Beach's resilience to these power outages. This will also utilize the recently developed guidelines for conducting maintenance outages during extreme heat events produced by SCE. Actions to be considered could include the creation of micro-grids focused on areas of criticality to allow localized electricity service to continue in the event of an outage. The City could also work with SCE to expand their current efforts on expanding energy storage. SCE is planning to connect almost 750 MW of energy storage to the grid by 2024, which would provide reliable backup systems for power outages. This program also focuses on expanding renewable energy storage by providing customer incentives for low-income customers that are already a part of their multifamily solar programs. This would both reduce strain on the grid and provide reliable power to vulnerable communities. Long Beach could propose to work with SCE to expand this program in the area.

**Implementation Steps:**

- Convene a working group with SCE to determine how LB can contribute to their existing efforts
- Partner with SCE to undertake electrical grid vulnerability assessment
- If necessary, develop a mitigation plan to prevent future power outages
- Identify and prioritize actions to build resiliency into the local electrical infrastructure through new actions or by partnering and expanding upon existing SCE actions

**Potential Cost Level:** TBD

**Equity Impacts:**

- This would help safeguard vulnerable populations such as the young, the elderly, as well as households in low-income and disadvantaged communities

### **EH-05: Expand implementation of the Urban Forest Management Plan**

Expand Long Beach's 2012 Urban Forest Management Plan, which sets the vision for the City's management of urban forest cover.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Neighborhood Services Bureau

**Partners:** Office of Sustainability, Parks, local community/neighborhood groups and stakeholders

**Timeline:** Short (0-3 years)

**Potential Performance Metrics:**

- # of trees planted
- # of trees planted in low-income and disadvantaged communities
- # of trees planted in areas most vulnerable to extreme heat, poor air quality, and lowest tree canopy coverage and access to green space

**Co-benefits:**

- Carbon sequestration
- Green jobs creation
- Stormwater management
- Aesthetic and property value improvements to neighborhoods
- Increased access to green spaces

**Description:**

Urban forests can serve an important role in climate change adaptation by lowering temperatures through the provision of shade and evaporative cooling. This is important as extreme heat is projected to increase in the Long Beach area leading to an increase in the urban heat island effect exacerbating heat-related illnesses and infrastructure deterioration.

Long Beach's 2012 Urban Forest Management Plan<sup>1</sup> has a vision of protecting, preserving, and expanding Long Beach's urban forest. This also led to the development of The Urban Forestry Program, a collaboration between neighborhood associations, community groups, and the Neighborhood Services Bureau which uses Federal Community Development Block Grant and State Funds to plant trees across the city. Since the Plan was enacted, the Urban Forest Program has planted 10,000 trees across the Long Beach.<sup>2</sup>

This City will continue to implement the Urban Forest Management Plan. This will include increasing the urban forest citywide and prioritizing expansion in disadvantaged communities that are most vulnerable

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<sup>1</sup> <https://ufmptoolkit.net/wp-content/uploads/2016/03/LongBeachUFMP.pdf>

<sup>2</sup> [http://www.lbds.info/neighborhood\\_services/neighborhood\\_improvement/urban\\_forestry\\_program.asp](http://www.lbds.info/neighborhood_services/neighborhood_improvement/urban_forestry_program.asp)

to extreme heat, poor air quality, and have a lack of green space and low existing urban forest coverage. Expansion would target communities that have a higher vulnerability to extreme heat due to their current lack of tree canopy and green space and/or ability to limit exposure to extreme heat (i.e., shelter, air conditioning).

**Implementation Steps:**

- Identify and prioritize tree planting in low-income and disadvantaged communities that are most vulnerable to extreme heat, poor air quality, and have a lack of green space and existing urban forest coverage
- Identify and involve community stakeholders in the planning process to ensure equitable distribution and that their voices are heard

**Potential Cost Level:** TBD

**Equity Impacts:**

- Expansion of urban forest and green space expansion efforts will reduce extreme heat exposure and improve air quality, especially in vulnerable neighborhoods such as West, Central, and North Long Beach that currently have limited urban forest coverage

#### **EH-06: Provide bus shelter amenities**

Provide more bus shelter amenities to help prevent health effects from long sun exposure and incentivize usage of public transportation.

**Scale of Action (Asset, Neighborhood, City Wide):** Citywide

**Implementation Lead:** Public Works, Long Beach Transit

**Partners:** Outdoor advertising company

**Timeline:** Short (0-3 years)

**Potential Performance Metrics:**

- % of bus stops with shade
- % of bus stops with real-time arrival information
- # of riders on routes with improved amenities

**Co-benefits:**

- Increase transit ridership, reducing GHG emissions

**Description:**

High-quality bus stops that include a combination of amenities such as shade, seating, and hydration stations can provide transit riders a refuge from high temperatures. This is especially critical for transit-dependent residents who rely on transit as their primary or only means of accessing key destinations and services. Transit dependency is particularly high for the young, elderly, sick, and disabled for whom exposure to extreme heat can have serious negative health impacts. Shaded, high-quality bus stops also play an important role in attracting new and retaining existing transit riders and increased transit ridership has strong air quality co-benefits.

There are public and private funding options for these improvements. For example, Long Beach Transit has utilized some of its Low Carbon Transit Operations Program (LCTOP), funded by cap-and-trade revenues, to upgrade bus stops and shelters. Advertising companies will often install and maintain street furniture in exchange for the right to place advertisements on them at little or no cost to cities.

Residents and businesses may request, through their City Council office, that bus stop amenities be installed. The City will also lead on recommending priority locations for bus stop amenities and prioritize improvements in low-income, disadvantaged communities (CalEnviroScreen), and areas with high transit-dependency. Additionally, it will ensure that the permitting and installation process is carried out through completion.

**Implementation Steps:**

- Identify and prioritize bus stops without shade structures on highly utilized routes that are in areas with high heat vulnerability
- Explore arrangements with an outdoor advertising company to fund bus stop amenities
- Engage with stakeholders to identify priority locations and desired bus stop features
- Permit and install new bus stop amenities on priority routes

**Potential Cost Level:** TBD

**Equity impacts:**

- Support all bus riders and increase ridership by making the wait more comfortable
- Improvements on routes used most heavily by low-income residents who are transit dependent will increase comfort, health, and safety



#### **EH-07: Expand accessibility of cooling centers**

Evaluate the existing cooling center network, increase usage of cooling centers citywide, and identify areas of expansion in communities most vulnerable to extreme heat.

**Scale of Action (Asset, Neighborhood, City Wide):** City wide, public and private buildings like schools, churches, temples, and mosques

**Implementation Lead:** Disaster Preparedness and Emergency Communications, Health and Human Services, Long Beach Parks, Recreation and Marine

**Partners:** Long Beach Unified School District and faith- and community-based organizations

**Timeline:** Short (0-3 years)

#### **Potential Performance Metrics:**

- # of publicly accessible cooling centers within the City
- # of publicly accessible cooling centers within the highest extreme heat vulnerability zone
- Accessibility measures such as capacity to serve local community, hours of availability, etc.
- usage of cooling centers during extreme heat events
- # emergency room visits from heat-related sickness during extreme heat events

#### **Co-benefits:**

- Reduce threat of heat-related sickness in vulnerable populations
- Strengthen social connectivity through using community-based networks and publicly accessible buildings
- Reduce the need for AC in private homes (electricity bills and energy usage)

#### **Description:**

As climate change increases the likelihood of frequent and intense extreme heat events, indoor facilities like cooling centers provide relief for those who are impacted by heat illnesses such as heat cramps, heat exhaustion, and heat strokes. For example, in the Long Beach CAAP survey, 58.5% said they remained indoors during heat advisories and 29% of respondents said they visited an air-conditioned areas such as cooling centers or malls. Certain populations such as the homeless, outdoor workers, older adults, young children and infants, pregnant women, and people with chronic illnesses are more susceptible to warmer temperatures and heat-related illnesses. In order to protect these populations, a strong and expansive network of cooling centers is important in transforming Long Beach to become more adaptive and resilient to the threat of extreme heat.

The City will evaluate the existing cooling center network to better understand the utilization characteristics of the 13 community centers and 12 libraries. Factors to be evaluated include the amenities and programming of the centers themselves, hours of operation, staff capacity and preparedness, awareness of the centers, barriers to access such as lack of transportation to and from, and

other variables. Once complete, the City will identify and implement a set of strategies to increase the usage and effectiveness of the network and individual centers. Improvements will be prioritized in low-income and disadvantaged communities most vulnerable to extreme heat. There are 15 cooling centers within the most disadvantaged areas of Long Beach (CalEnviroScreen). The City will also work with faith- and community-based organizations to allow churches, temples, mosques, and other buildings to become publicly accessible during heat events.

**Implementation Steps:**

- Undertake an evaluation of the existing network and identify various means to expand usage
- Partner with school district and faith- and community-based organizations to identify new cooling center spaces

**Potential Cost Level:** TBD

**Equity Impacts:**

- Aids those most at-risk to heat-related injury, like people experiencing homelessness, outdoor workers, older adults, young children and infants, pregnant women, and people with chronic illnesses.
- Strengthens social connectivity through using community-based networks and publicly accessible buildings

### **AQ-01: Incentivize installation of photocatalytic roofing tiles**

Support the installation of photocatalytic tiles to improve air quality.

**Scale of Action (Asset, Neighborhood, Citywide):** Neighborhood

**Implementation Lead:** Development Services

**Partners:** Department of Health and Human Services, Port of Long Beach, South Coast Air Quality Management District (SCAQMD)

**Timeline:** Medium (3-6 years)

**Potential Performance Metrics:**

- # of photocatalytic roofs deployed
- % of estimated reduction of NOx and ozone in the City of Long Beach

**Co-benefits:**

- When combined with reflective roofing material, smog-reducing granules can lower both indoor and outdoor temperature while reducing air pollution

**Description:**

There are a growing number of photocatalytic roofing tile products on the market. Titanium-dioxide coated granules that photocatalytically convert NOx into water-soluble ions are embedded into cool-roofing products, actively reducing air pollution.

If deployed on Long Beach roofs, these new roofing materials could reduce smog at the same time as they reduce temperatures. The City will actively pursue grant funding options to incentivize installation of these tiles with priority for neighborhoods and communities near the Port and the I-710 corridor that are heavily impacted by air pollution. Several of California's cap-and-trade programs prioritize funding projects in disadvantaged and low-income communities that reduce energy use and GHGs from building end uses. Integration of photocatalytic products into building energy efficiency projects, affordable housing developments, and similar projects could result in meaningful air quality co-benefits. Additionally, in response to AB 617 (the Community Air Protection Program) air districts are tasked to work with identified impacted communities to identify projects to reduce air pollution exposure. West Long Beach (extending all the way to Cherry Avenue) was selected as one of the initial focus communities in 2018.

The City will support the inclusion of photocatalytic tiles in projects located in areas of the city heavily impacted by pollution. This will include collaborating with the SCAQMD, community partners, developers, and other stakeholders to identify projects where they could be included as one component of projects that seek to more holistically address GHG and/or air quality emissions reductions. Additionally, for any projects that implement photocatalytic tiles the City will work with SCAQMD to quantify air pollutant reductions.

**Implementation Steps:**

- Work with SCAQMD, community groups, and stakeholders to identify projects that could incorporate photocatalytic tiles as part of a more holistic emissions reduction strategy
- Pursue funding to retrofit existing buildings, new developments, and/or redevelopments could incorporate photocatalytic tiles as part of a more holistic emissions reduction strategy
- Partner with SCAQMD to monitor air pollutant reductions resulting from the installation of photocatalytic tiles
- Contingent on initial success, explore code changes to require or incentivize photocatalytic tiles in impacted communities

**Potential Cost Level:** TBD

**Equity Impacts:**

- Improved air quality for communities and population groups most heavily impacted by air pollution

## **AQ-02: Support the development of the Long Beach Airport Sustainability Plan**

Work with Long Beach Airport to support the development of their Sustainability Plan with a focus on reducing emissions from vehicles and equipment at the airport. Additionally, support efforts to explore the feasibility of electric-powered airplanes into its fleet.

**Scale of Action (Asset, Neighborhood, Citywide):** Asset

**Implementation Lead:** Long Beach Airport

**Partners:** Airlines, aviation industry companies

**Timeline:** Long (6+ years)

### **Potential Performance Metrics:**

- Reduction in local air quality pollutants

### **Co-benefits:**

- GHG emissions reductions
- Potential energy savings

### **Description:**

Long Beach Airport is working on its Sustainability Plan, which will include an evaluation of the areas where the Airport can improve existing programs or introduce new programs to improve air emissions, energy, water, waste, and community.

The City will support the Airport in its efforts to reduce emissions from ground vehicles and equipment, including expanding zero emission vehicle fleets, electric-charging infrastructure, and pursuing Airport Carbon Accreditation.

In the long term, the City and Airport will explore the feasibility of incorporating emerging electric-powered planes into the fleet. Overall, the aviation industry accounts for 11 percent of all transportation-related GHG emissions in the United States as a result of burning jet fuel and releasing NO<sub>x</sub> and CO<sub>2</sub> (Schlossberg, 2017). Transforming the Long Beach Airport to be a center of GHG reduction innovation will allow the City to become a national leader in climate mitigation and improve local air quality.

Longer-term as technologies evolve there is likely to be an increasing number of opportunities to support the integration of electric airplanes into the Airport's fleet. Regional flights are expected to be the strongest candidates for integration. For example, the venture arm of Jetblue, one of the airports anchor airlines, has invested in Zunum (also backed by venture arms of Boeing and Washington state's Clean Energy Fund), which expects to have a hybrid-electric 12-seater plane available in 2022. For longer flights requiring jet fuel planes, the City will work with airlines such as Delta and JetBlue to further promote their existing carbon offset programs to customers to increase uptake.

**Implementation Steps:**

- Work with the Long Beach Airport to support the development and implementation of its Sustainability Plan
- Support the long-term integration of electric-powered airplanes operating out of Long Beach
- Encourage airlines to facilitate customers to buy carbon offsets through their ticket purchase process

**Potential Cost Level:** TBD

**Equity Impacts:**

- Improved air quality for socially vulnerable communities around the airport as identified in the Long Beach Social Vulnerability to Climate Change Map (<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7150>)
- Reduced noise pollution for neighborhoods situated around Long Beach airport

### **AQ-03: Electrify local, small emitters**

Support the replacement of fossil fuel-powered small engine equipment with electric-powered equipment.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Public Works, Parks, Recreation and Marine

**Partners:** South Coast Air Quality Management District (SCAQMD)

**Timeline:** Short (0-3 years) and Medium (3-6 years)

#### **Potential Performance Metrics:**

- # of incentives received from SCAQMD Commercial Electric Lawn and Garden Incentive and Exchange Program
- # of pieces of small emitter equipment transitioned to electric

#### **Co-benefits:**

- Reduction of local air pollution and particulate matter
- Reduction of noise from leaf blowers, lawn mowers, and other landscaping equipment

#### **Description**

Small off-road engines are spark-ignition engines that produce less than 19 kilowatts gross power (and less than 25 horsepower). They are primarily used for lawn, garden, commercial utility, and other outdoor power equipment. Unfortunately, small off-road engines that use gasoline or diesel contribute greatly to local air pollution. According to the California Air Resources Board, in one hour, a traditional lawn mower can emit as much smog-forming pollution as the best-selling passenger car driving 300 miles – approximately the distance from Los Angeles to Las Vegas. A traditional leaf blower in one hour of operation emits smog-forming pollution comparable to driving about 1,100 miles, or approximately the distance from Long Beach to Denver.

As of 2017, the population of small engines in California (16.7 million) is estimated to be greater than that of light-duty passenger cars (13.7 million). The engines are comprised of 77% residential lawn and garden equipment, 9% commercial lawn and garden equipment, 11% federally regulated construction/farming equipment, and 3% other equipment types (e.g., generators, utility carts). In Long Beach, it is unknown the amount of fossil fuel-powered small engines operated by the City, from commercial landscapers, and from residential owners. Therefore, before embarking on the transition, the City will evaluate how many small engines will need replacement.

The City will conduct outreach and education efforts to inform the general public of the emissions impacts of this equipment and work with the South Coast Air Quality Management District (SCAQMD) to publicize

its Electric Lawn and Garden Equipment Incentive and Exchange Program and Residential Lawn Mower Rebate Program. Local governments, commercial landscapers, school districts, colleges, non-profits, and residents are eligible to participate. One equivalent operable gasoline- or diesel-powered piece of lawn and garden equipment must be scrapped to receive incentive funding to purchase an electric-powered equipment. Furthermore, SQAQMD is prioritizing funding in disadvantaged communities (CalEnviroScreen). The city can also apply for incentives to transition its own fleet of equipment. Additionally, the City will identify strategies to accelerate the transition in disadvantaged communities and assist landscaping workers to transition with reasonable cost. A voucher program would be one example of such a strategy.

In the medium-term, City of Long Beach will phase out fossil fuel-powered lawn and garden equipment. For example, the City will implement the Board of Health and Human Services recommendation to require fossil fuel-powered leaf blowers to be model years 2007 or newer and 65 decibels (sound level) or less. At least 50 cities across the state have some sort of regulation on lawn and garden equipment already.

#### **Implementation Steps:**

- Evaluate how many engines citywide can be transitioned from fossil fuel-powered to electric.
- Apply for incentives as well as assist commercial landscapers and residential owners apply to transition their equipment.
- Prioritize phase-out in disadvantaged communities with the worst air quality.
- Phase out City-owned fossil fuel-powered lawn and garden equipment.

**Potential Cost Level:** TBD

#### **Equity Impacts:**

- Improved air quality for vulnerable communities, and potentially reduce the occurrence of asthma, cardiovascular disease and premature death caused by air pollution



#### **AQ-04: Support school bus electrification**

Explore opportunities to transition the Long Beach Unified School District school bus fleet from diesel-powered to electric vehicles.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Long Beach Unified School District

**Partners:** California Air Resources Board (CARB), California Energy Commission (CEC), South Coast Air Quality Management District (SCAQMD), Southern California Edison (SCE)

**Timeline:** Short (0-3 years)

**Potential Performance Metrics:**

- # of diesel buses switched to electric power
- % reduction in local pollutants
- \$ of grant funds secured to for electric buses

**Co-benefits:**

- Improved public health, especially youth directly impacted by school bus emissions

**Description:**

The negative effects of using diesel-powered school buses are well documented. Pollution levels inside school buses are greatly affected by the bus's own exhaust and early childhood exposure to higher concentrations of particulate matter (PM) affects lung development and can cause respiratory health effects later in life. Transitioning diesel-powered buses to electric power will have positive, long-term public health impacts for children.

In the Long Beach Unified School District, daily school bus transportation has been discontinued since 2013. However, school buses are still used for transporting students to field trips and athletic events. School buses are also regularly used by students enrolled in the district's Special Education Program.

The City and Long Beach School District will explore opportunities to transition its current diesel-powered fleet. This will include applying for incentives for buses and supportive infrastructure such as charging stations. There is a significant amount of funding available from state sources such as the Hybrid Voucher Incentive Program and Volkswagen Mitigation Environmental Trust (administered through Air Resources Board), Prop 39: School Bus Replacement Program (administered through California Energy Commission) and the Carl Moyer Program and AB 617 Community Air Protection Funds (administered through SCAQMD). The eligible costs for these funds include lower emission or zero-emission school buses, electric charging infrastructure, and workforce training and development. Most of the programs have a priority for disadvantaged communities (CalEnviroScreen).

**Implementation Steps:**

- Evaluate the total number of diesel-powered buses serving in the Long Beach Unified School District fleet
- Apply for funding from state and local sources to transition diesel-powered buses to electric
- Identify schools in zones with the poorest air quality to prioritize electric bus service first

**Potential Cost Level:** TBD

**Equity Impacts:**

- Improved air quality for vulnerable communities and improved public health

#### **AQ-05: Increase monitoring of oil extraction and refining process**

Establish air monitors outside of active wells and refineries that are within LB borders. Audit survey of all methane emissions to check possible emissions coming from either active or abandoned oil wells.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Health and Human Services, Energy Resources

**Partners:** Office of Sustainability

**Timeline:** Medium (3-6 years)

**Potential Performance Metrics:**

- # of air monitors established

**Co-benefits:**

- Availability of data to inform both state and regional regulators and others looking to protect their health
- If leaks identified through the monitoring, could lead to a reduction in fugitive methane emissions, a gas with a potent global warming potential

**Description:**

The State of California has some of the strictest air emission policies in the United States. In 2013, the Interagency Refinery Task Force was formed under which the California Air Resources Board and California Air Pollution Control Officers Association were tasked with monitoring refineries across the entire state. Their March 2019 Report stated the need to increase air monitoring systems to gather relevant, reliable air quality data in real time to help make informed safety decisions.<sup>3</sup> This is a priority for the State and impacts Long Beach and its residents. The City will increase its participation in this process and help grow this air monitoring network.

Air pollution is a major threat to public health and carries increased risk for vulnerable populations. In a 2006 assessment, the Long Beach Health Department found that 14% of residents suffer from asthma which is 2.5% higher than Los Angeles and 6 percent higher than the entire U.S. This report found that people of color and low-income communities were disproportionately impacted.<sup>4</sup> All air quality actions done by the city will focus on these vulnerable communities first to ensure they are prioritized.

The City will audit all methane emissions from active or abandoned oil wells to check for possible non-compliance. The City will also establish new air monitors outside of active wells and refineries that are

<sup>3</sup>

[https://www.arb.ca.gov/fuels/carefinery/crseam/o2reamarfinal.pdf?\\_ga=2.229849436.1753290818.1556884983-233947209.1551451149](https://www.arb.ca.gov/fuels/carefinery/crseam/o2reamarfinal.pdf?_ga=2.229849436.1753290818.1556884983-233947209.1551451149)

<sup>4</sup> <http://www.calhealthreport.org/2016/03/07/breathing-air-into-asthma-prevention-in-long-beach/>

within the City limits, particularly focusing on communities most vulnerable to poor air quality. The City will review CalEnviroScreen maps in relation to oil operations to identified prioritized areas for air monitoring. Data from these actions will be made available to the public and will be regularly sent to regulators and the California Air Resources Board for review.

By stepping up Long Beach's participation and offering local assistance to the State, the City hopes to reduce harmful air pollutants and the associated health impacts to our most vulnerable citizens.

**Implementation Steps:**

- Connect with the California Air Resources Board and California Air Pollution Control Officers Association while developing program
- Establish air monitors outside of active wells and refineries and create a schedule to regularly check their methane emissions
- Conduct audits at wells and refineries to monitor compliance
- Provide data to the public
- Report out of compliance locations to the State

**Potential Cost Level:** TBD

**Equity Impacts:**

- Prioritizing vulnerable communities for air monitoring and reducing localized air pollutants near active and abandoned wells and refineries could have significant health benefits to the communities living nearby

### **DRT-01: Implement additional water conservation programs**

Implement additional water conservation programs to help reduce water use and demand.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Long Beach Water

**Partners:** Office of Sustainability

**Timeline:** Short (0-3 years)

#### **Potential Performance Metrics:**

- # of new programs established
- Reduced water use overall and by subarea

#### **Co-benefits:**

- Conservation of gas and electricity needed to distribute and heat water, reducing GHG emissions
- Resident and business cost savings
- Protects upstream rivers and wildlife habitats
- Reduces urban run-off polluting coastal waters (if reducing landscape irrigation)

#### **Description:**

Long Beach is located in the semi-arid region of Southern California that relies on imported water, a process which uses 20% of the state's electricity.<sup>5</sup> Conserving water is imperative to reducing costs and resource usage now, as well as bolstering our water security for the future. In an effort to reduce water use, the State of California enacted Assembly Bill (AB) 1668 and Senate Bill (SB) 606 in 2018 which emphasizes the efficiency of water use and stretching existing water supplies. The legislation sets an initial limit for indoor water use of 55 gallons per-person per-day in 2022 and gradually drops to 50 gallons per person by 2030. This legislation is not imposed upon the individual citizens, but instead the urban water suppliers.<sup>6</sup>

In order to achieve the targets set forth by AB 1668 and SB 606, Long Beach Water will identify and move forward with further water conservation programming to help reduce overall usage. Long Beach's Urban Water Management Plan, last updated in 2015 and updated every five years, outlines current and future actions and strategies to manage and conserve water.

Water conservation provides cost savings to residents, through water utilities and through electricity and gas utilities due to the need for these resources to transport and heat water. Reducing utility cost burdens will play a role in controlling costs for residents and businesses.

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<sup>5</sup> <http://www.lbwater.org/Residential%20Conservation>

<sup>6</sup> [https://www.waterboards.ca.gov/publications\\_forms/publications/factsheets/docs/water\\_efficiency\\_bill\\_factsheet.pdf](https://www.waterboards.ca.gov/publications_forms/publications/factsheets/docs/water_efficiency_bill_factsheet.pdf)

**Implementation Steps:**

- Continue to monitor AB 1668 and SB 606 on water restriction and conservation
- Conduct outreach to residents to ensure they understand programs available and eligibility
- Establish and adopt city-wide goals for residential water use reduction that match the 2018 legislation and options to achieve them
- Utilize pricing to encourage high-water users such as large lot homeowners to reduce water consumption

**Potential Cost Level:** TBD

**Equity Impacts:**

- Programs will look to target low-income communities to decrease water usage and utility costs for residents

**DRT-02: Develop additional water supplies or other actions as prescribed in the Urban Water Management Plan**

Develop additional local water supplies to establish a more diverse water supply portfolio that is more resilient to drought.

**Scale of Action (Asset, Neighborhood, City Wide):** Citywide

**Implementation Lead:** Long Beach Water, Public Works

**Partners:** Metropolitan Water District of Southern California, Water Replenishment District of Southern California, Long Beach Water Board

**Timeline:** Medium (3-6 years)

**Potential Performance Metrics:**

- % reduction in imported per-capita water demand
- # of green stormwater infrastructure projects
- # of rainfall capture installations
- # of recycled water/purple pipe/greywater projects completed

**Co-benefits:**

- Vegetation in green infrastructure projects has cooling effect, aids water quality, provides source control of stormwater, reduces pollutant conveyance to the collection system, and provides environmentally enhanced roads
- Overall reduction of GHG emissions from importing water
- Conservation of gas and electricity needed to distribute and heat water

**Description:**

Climate change will result in both a decreased amount of water supply (evaporation, lessening snowpack, etc.) and an increased need for water (hydration, cooling, and irrigation). Additionally, years of drought and extreme rain have made water supply unpredictable. As detailed in the City's 2015 Urban Water Management Plan Long Beach Water Department (LBWD) purchases 40 to 60 percent of its demand for water from the Metropolitan Water District (MWD) of Southern California in any given year. Even though City of Long Beach has been a regional leader in water conservation, the LBWD will need more diverse water supply alternatives to be resilient as the Long Beach's population grows and climate change impacts such as extreme heat make a resilient and dependable water supply even more critical.

The City will identify and implement strategies to diversify the water supply, increase resiliency to drought, and reduce reliance on imported water. Strategies that will be pursued include expansion of green streets and infrastructure to capture rain and run-off, increased rainfall capture, and expansion of water recycling and reuse such as greywater and purple pipe. The City will prioritize green infrastructure and rainfall capture programs for the benefit of disadvantaged communities (CalEnviroScreen) and neighborhoods that are most vulnerable to extreme heat since they have multiple co-benefits such as green space and reduced water costs.

The City also plans to improve recycled-water technologies citywide in order to install more recycled water/purple pipes. Currently five million of the 25 million gallons of water treated per day at the Long Beach Water Reclamation Plant is reused at over 40 reuse sites and opportunities for expanding this percentage will be explored through an analysis. Additionally, greywater used for irrigation will be incorporated into new buildings when possible. This would expand upon the City pilot program that took place in 2012-2013 for greywater irrigation from washing machines.

In general, water reuse is already happening in the community and there is public support for this to expand and continue. Funding potentially available for water infrastructure are Prop 68, Measure W, and Prop 3. Rebates and incentives are available through MWD.

#### **Implementation Steps:**

- Create a Long Beach adaptive management plan as outlined in the 2015 Metropolitan Water District (MWD) Integrated Water Resources Plan
- Apply for funding sources to upgrade water infrastructure, like Prop 68, Measure W and Prop 3
- Prioritize investments in disadvantaged communities that will support and/or expand green space

**Potential Cost Level:** TBD

#### **Equity Impacts:**

- Certain water infrastructure projects can add greenery and cooling benefits to neighborhoods that are heavily covered by asphalt and lack parks and green space
- By using recycled water, potable water sources will free up and aid resilience
- Decrease water usage and costs for residents in low-income communities



**DRT-08: Continue outreach and education related to water conservation**

Continue public outreach campaigns to promote efficient water use.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Long Beach Water

**Partners:** Office of Sustainability

**Timeline:** Short (0-3 years)

**Potential Performance Metrics:**

- # of education and outreach events
- # of individuals and businesses reached

**Co-benefits:**

- Community engagement on other CAAP initiatives
- Conserving water conserves gas and electricity needed to distribute and heat water, reducing GHG emissions
- Reduce water, electricity, and gas utility costs to residents

**Description:**

As noted in DRT-01, AB 1668 and SB 606 set limits on per capita daily water use that are gradually reduced over time. Although these limits are imposed on water-suppliers end users such as households and businesses have a critical role to play in reducing water consumption. Education about choices and behaviors can go a long way to meeting citywide water conservation goals.

Water conservation also has meaningful cost savings potential which will continue to be a core part of Long Beach Water's ongoing efficiency outreach and education.

Long Beach Water Department has a user friendly and interactive website that features a variety of water conservation educational materials and programming. In order to refresh and draw attention to these opportunities, the city will launch an ad campaign focusing on water conservation at home, importance of water to the region, and how it all translates to cost savings to Long Beach residents. The campaign will also start the roll-out of new conservation trainings and workshops. Outreach and education will target high water usage communities and low-income communities.

**Implementation Steps:**

- Identify partners and participants for water conservation outreach and education
- Develop outreach and educational programming

- Roll out ad campaign and begin providing educational opportunities to interested citizens, including information on the newly established city wide goal for residential water use reductions

**Potential Cost Level:** TBD

**Equity Impacts:**

- Outreach to low-income communities can result in meaningful cost savings

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**DRT-04: Encourage urban agriculture practices that promote drought resilience**

Continue to incentivize the use of drought tolerant urban agriculture practices and projects in community and home gardens.

**Scale of Action (Asset, Neighborhood, Citywide):** Citywide

**Implementation Lead:** Office of Sustainability

**Partners:** Water Department

**Timeline:** Short (0-3 years)

**Potential Performance Metrics:**

- # of events and trainings held
- # of incentives provided

**Co-benefits:**

- Increased local food security and strengthened local food system
- Public health benefits resulting from healthy food access
- Decreased urban heat island effect and improved water management due to green infrastructure

**Description:**

Local urban agriculture provides increased access to healthy and local food for all Long Beach residents. As Southern California is located in a water stressed region and water restrictions are now a regular occurrence, it is important that drought-tolerance be built into these urban agricultural systems.

This action will provide new incentives for drought-tolerant urban agriculture practices to home and community gardens. The program development will explore incentive provisions for drought tolerant seeds and plants, rain catching and drip irrigation systems, and other water conservation equipment. Long Beach Water Department has a robust Lawn-to-Garden (L2G) program, which provides rebates for replacing grass with drought tolerant gardens.<sup>7</sup> The City will explore expanding this program to include urban agricultural components.

The City will also develop new educational and training opportunities for drought tolerant urban agriculture. Long Beach regularly holds free urban gardening workshops at the Civic Center Edible Garden. These workshops could be expanded to have a drought-resilient focus and to be located in additional locations to allow equitable attendance. Education and outreach could include demonstration plots, soil conservation practice trainings, drip tape irrigation trainings, and other materials on relevant urban agriculture water conservation practices. These trainings could also be expanded to other locations in the city with a focus on low-income areas to allow for more equitable attendance.

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<sup>7</sup> <https://lblawntogarden.com/>

**Implementation Steps:**

- Develop parameters for incentive program (new or tying into the current L2G program)
- Roll out incentives along with outreach on program and eligibility
- Develop and provide educational opportunities to citizens on drought-resilient urban agricultural practices

**Potential Cost Level:** TBD

**Equity Impacts:**

- Drought-resilient gardening leads to increased local food production, potentially decreasing local food insecurity in vulnerable neighborhoods

### **FLD-01: Establish a floodplain ordinance**

Establish a floodplain ordinance to limit, elevate, or provide flood-proofing standards for development in areas designated as vulnerable to flooding in order to minimize property impacts from flooding.

**Lead:** Planning and Building

**Partners:** FEMA, Neighborhoods located in existing and future coastal and riverine floodplains

**Timeline:** Short

#### **Potential Performance Metrics:**

- Established ordinance

#### **Co-benefits:**

- Reduction of flood insurance rates of 5 to 45%
- Increase in awareness of SLR issues in the City

#### **Description:**

As a participant of the National Flood Insurance Program, the City already enforces a minimum design standard of the base flood elevation (BFE) for first floor building elevations (Chapter 18.73 [Flood-Resistant Design and Construction] of the City's Building Code). Although building codes can improve the chances that a structure will survive an extreme storm, additional regulation may be necessary to ensure adequate flood protection for the area. Adoption of a Floodplain Ordinance will emphasize flood risks posed to the City and introduce regulations and programs to promote long-term flood resilience for buildings located in the floodplain.

Sea level rise will increase the height of floodwaters and inland extent of floodplains. The Ordinance will introduce incentives to help facilitate building owners located in FEMA-designated flood areas to proactively invest in resiliency improvements by either meeting or exceeding flood-resistant construction standards, even when they are not required by FEMA or City Building Code. Incentives will include City-led pursuits of FEMA grants to subsidize flood-proofing and elevating properties as well as the removal of regulatory obstacles to incorporate resiliency standards in design. This precautionary approach helps make buildings safer in the long-term, thereby decreasing the chance of future property damage. By exceeding minimum FEMA floodplain requirements, the City may also reduce flood insurance premiums through FEMA's Community Rating System (CRS).

The ordinance will include new base flood elevations informed by current science. Future updates to the ordinance will incorporate the latest science and projections and local impact monitoring. Longer-term updates may consider managed retreat if science and monitoring of local impacts warrant it.

In summary, the Floodplain Ordinance provides building owners living and working in the floodplain the option to design or retrofit buildings to reduce damage from existing and future floods and potentially reduce long-term flood insurance costs. Overall, implementation of the action would improve the ability of the city's flood-prone neighborhoods to withstand and recover quickly from coastal flooding.

#### **Implementation Steps:**

- Review Chapter 18.73 (Flood-Resistant Design and Construction) of the Long Beach Building Standards Code against (FEMA) standards to determine if existing code can be updated to include future sea level conditions or if a separate ordinance is required.
- Use sea level rise inundation maps and CAAP to develop minimum design standards to be considered for long-term flood protection.
- Ensure other building code regulations (e.g., setbacks, building heights) are consistent with higher standards developed for the Floodplain Ordinance.
- Pursue competitive FEMA grant programs to subsidize individual building owners in elevating and flood-proofing their properties
- Explore the potential beneficial impacts higher minimum design standards could have on insurance premiums

#### **Potential Cost Level: TBD**

#### **Equity Impacts:**

- A floodplain ordinance will minimize property impacts from flooding in all neighborhoods, including areas socially vulnerable to climate change, as identified in the Long Beach Social Vulnerability to Climate Change Map (<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7150>)
- Subsidization programs may enable building owners in West Long Beach and other impacted neighborhoods the ability to build or retrofit to a higher flood protection standard

**FLD-02: Incorporate sea level rise language into citywide plans, policies, and regulations**

Mainstream sea level rise adaptation by incorporating sea level rise impacts into relevant plans, policies, and regulations (e.g., General Plan, neighborhood plans, Local Coastal Program, design standards for capital projects).

**Implementation Lead:** Planning and Building, Public Works

**Partners:** Varies based on planning document

**Timeline:** Short

**Potential Performance Metrics:**

- List of relevant strategies, policies, and regulations and timeline for incorporating sea level rise language
- # of strategies, policies, and regulations updated consistent with the timeline

**Co-benefits:**

- Increase in longevity of project by considering SLR
- Increase in awareness of SLR issues in the City
- Assistance with any future applications to FEMA as well as compliance with SB 379

**Description**

City planning documents are tangible opportunities to integrate sea level rise into a citywide planning framework. Incorporating language related to sea level rise in City policies, plans, and guidelines can ensure that future investments by the City consider potential flood impacts and incorporate adaptation strategies, as appropriate.

Mainstreaming sea level rise adaptation into planning and decision-making processes requires a coordinated, citywide effort. However, most decision-making responsibilities are allocated to specific functional areas or departments and follow relatively codified procedures, particularly where specialized knowledge is required. In general, city planning documents fall into two high level categories: overarching planning documents and design guidelines. To help meet the City's goal of enhancing resilience to future climate conditions, language addressing sea level rise impacts will be added to both types of documents.

Overarching documents, such as the General Plan, are high level and focus on the City's priorities. It is particularly important to influence overarching plans that aim to enhance the capacity and performance of operations and assets, often with a longer-term, strategic perspective. These documents provide the opportunity to introduce, coordinate, and generate knowledge, and present a vision of long-term resilience.

Design guidelines, such as design standards for capital projects, are detailed and provide guidance to technical practitioners. Existing building codes and minimum design standards are primarily based on historical weather data without accounting for changing climate conditions, such as the increasing frequency and magnitude of coastal flood events. Updating design criteria to consider future sea level conditions is a critical step toward integrating resilience as a core principle into the design of City infrastructure and facilities. Updating prevailing design guidelines, standards, and specifications allows the City to evaluate the risk tolerance of city assets and guides project design. Prioritizing the update of design guidelines is particularly important to ensure opportunities to influence the construction or major renovation of assets with a long design life (e.g., bridges, stormwater infrastructure, seawalls, etc.).

#### **Implementation Steps:**

- Review and identify relevant strategies, policies, and regulations that should be prioritized for language updates to consider future sea level rise conditions.
- Use sea level rise inundation maps and CAAP to inform updates currently being done by the City.
- For lower priority strategies, policies, and regulations, consider adding sea level rise language in coordination with planned update cycles.

**Potential Cost Level:** TBD

#### **Equity Impacts:**

- Integration of sea level rise in future planning and design will increase the flood resilience to all neighborhoods, including areas that are socially vulnerable to climate change, as identified in the Long Beach Social Vulnerability to Climate Change Map (<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7150>)



### **FLD-03: Establish a flood impacts monitoring program**

Streamline the collection and analysis of flood impact data for collecting photo and video documentation during and after storms or other flooding events so the City may compare SLR and flood projections with realities on the ground. This could be done in partnership with local schools including CSULB, LBCC and/or LBUSD.

**Lead:** Disaster Preparedness & Emergency Communications, Public Works, Sustainability Office, Tideland Capital Improvement Division

**Partners:** Local schools, neighborhood associations, local businesses

**Timeline:** Short

#### **Potential Performance Metrics:**

- Established program
- # of annual crowdsourced documentations

#### **Co-benefits:**

- Site or neighborhood specific data can improve City flood response
- Increased public engagement in flood response

#### **Description:**

When flooding occurs, data for site-specific conditions can help the City to better understand how factors in the urban landscape (e.g., paved surfaces, drainage networks, and city infrastructure) exacerbate local water levels and damages associated with storm events. Although the hazard of flooding continues to affect the city every year, the ability to know when and where flooding occurs and communicate the risks to the public is limited.

A flood monitoring program that harnesses the power of citizen reporting through crowdsourcing platforms such as smartphone photos, webcams, and social media posts will connect residents with city officials and emergency managers, providing a first-hand look at flood risks throughout the city. The prevalence of smart phones and webcams have created a new opportunity to evaluate the magnitude and associated damages of flooding and offering a tool for communities to protect themselves against flood events.

Uploaded data collected by residents can be automatically geolocated and added to a map interface that is viewable by city officials and the public. During the event, the real-time data is useful for emergency managers and may improve response times. Following the event, the City can review the information to address flooding hot spots and monitor the effectiveness of implemented flood adaptation strategies. The City will establish the platform and perform annual data reporting that includes aggregate data and how the data has informed City adaptation efforts.

**Implementation Steps:**

- Assess internal resources for crowdsource capability and/or evaluate costs and timeline for developing a platform
- Identify and implement the preferred crowdsource platform
- Host outreach events with the schools, neighborhood meetings, etc. to train the public on the importance of the tool and how to use it
- Train City staff how to incorporate findings from the platform into infrastructure improvements.
- Complete annual data reporting

**Potential Cost Level:** TBD

**Equity Impacts:**

- A crowd-sourced floodplain monitoring program will provide all residents, particularly those most impacted by climate change, with a tool to highlight local flooding in their neighborhoods. The City will be able to more effectively address acute flood incidents as well as develop and implement preventative measures

## **FLD-04: Incorporate adaptation into City lease negotiations**

Include requirements and incentives for implementing adaptation strategies into new and renewed leases on City-owned land.

**Lead:** Economic Development

**Partners:** California Coastal Commission, City lease holders

**Timeline:** Short

### **Potential Performance Metrics:**

- Updated leasing guidelines
- # and type of adaptation strategies incorporated into leases

### **Co-benefits:**

- Less service interruption to tenants located in flood zones
- Increased awareness of flood risks for potential tenants
- Avoidance of environmental impacts to the region during large flood events
- Reduced GHG emissions

### **Description:**

Currently, a lease is required for tenants to occupy properties or land owned by the City. Because much of this City-owned property is located in areas vulnerable to flood exposure, including sea level rise and flood adaptation requirements into lease negotiations will provide enhanced flood resilience for tenants and may avoid adverse environmental impacts. City leases also provide a vehicle to include adaptation strategies that will address extreme heat, air quality, and drought, and achieve GHG reduction co-benefits. As such, the City will include an adaptation section in the lease applications. The new section will include a simplified map of flood vulnerability, extreme heat, and air quality zones or proximity to major emissions sources. The flood vulnerability map will include future sea level rise and questions regarding the proposed location, maximum life span of infrastructure on the site, potential consequences of flooding, and a description of feasible adaptation measures. Similarly, the City will establish incentives and/or requirements to address extreme heat, air quality, drought, and reduce GHG emissions, which will be based on the exposure to climate change impacts and the potential benefits of adaptation strategies.

A guidance document will be developed to assist City staff in understanding key terms used to evaluate future impacts and making informed decisions regarding lease permits. Project examples and an internal checklist for staff reviewing applications will also be included.

**Implementation Steps:**

- Develop simplified maps of sea level rise flood extents, extreme heat, and air quality overlaid on city-owned property
- Establish leasing guidelines that include incentives, requirements, or a combination thereof to incorporate adaptation (and mitigation co-benefit) components into new and renewed leases
- Insert sea level rise and flood section into tenant lease agreement
- Train City staff on how to perform evaluations effectively and answer relevant questions from the applicant

**Potential Cost Level:** TBD

**Equity Impacts:**

- Several areas of City-owned property available for lease may be located in disadvantaged communities. Including adaptation (and mitigation co-benefit) considerations into lease negotiations may will increase overall resiliency and adaptive capacity

### **FLD-05: Update the City's existing Stormwater Management Plan**

Update the City's existing Stormwater Management Plan to account for flood risks associated with climate change and develop a funding/implementation plan for fully funding storm drain and pump station improvements.

**Lead:** Public Works

**Partners:** LA County

**Timeline:** Short

#### **Potential Performance Metrics:**

- Updated Stormwater Management Plan
- Funding and implementation plan

#### **Co-benefits:**

- Increase in longevity of projects through consideration of sea level rise and riverine flooding
- Increase in awareness of SLR issues in the City
- Assistance with any future applications to FEMA as well as compliance with SB 379

#### **Description**

The Stormwater Master Plan includes an inventory of stormwater assets, field investigations, hydraulic modeling, and recommendations for capital improvements and expanded inventory data collection and maintenance programs. Its stated primary purpose is to protect water quality by preventing pollutant discharges to receiving waters.

In addition to protecting water quality, the City will update the Stormwater Master Plan to also prioritize efficient conveyance of excess stormwater to prevent inland flooding. Updating the Master Plan will include developing an up-to-date Hydrological and Hydraulic (H&H) model of the City's major watersheds to include new information regarding changes in climate and rising tides will help the City better understand how its infrastructure will perform under changing storm scenarios. The updated H&H watershed modeling will incorporate climate changes stressors, including both changes in future precipitation patterns and rising sea levels. The updated Stormwater Master Plan will also evaluate the existing capacity of the system to convey and drain excess stormwater and identify capital improvement projects to increase drainage efficiency and protect new and existing electrical and mechanical equipment (e.g., pump stations) from potential flood damage.

#### **Implementation Steps:**

- Review and identify sections of the Plan that could be updated with sea level rise language
- Review and incorporate data collected in SLR-31/RIV-03

**Potential Cost Level:** Low, Medium, High

**Equity Impacts:**

- Integration of sea level rise in future planning and design of the stormwater drainage system will increase the flood resilience to all neighborhoods, including socially vulnerable areas as identified in the Long Beach Social Vulnerability to Climate Change Map (<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7150>)

**FLD-06: Conduct citywide beach stabilization study**

Conduct a citywide study to assess the feasibility of a combined nourishment and sand retention program. Study will estimate sand volumes required to keep pace with SLR, costs, and potential sources of sand.

**Implementation Lead:** Parks, Recreation, and Marine, Public Works

**Partners:** U.S. Army Corps of Engineers (USACE), local universities, U.S. Geological Service (USGS)

**Timeline:** Short

**Potential Performance Metrics:**

- Completed study

**Co-benefits:**

- Increased recreational opportunities for residents and tourists

**Description:**

To maintain property protection and recreational benefits of the City's beaches, engineering intervention will be necessary. Beach nourishment refers to the introduction of sediment onto a beach and is primarily used to offset eroding conditions. Ideally, a beach nourishment project will respond to seasonal changes in wave and current conditions, but is designed so the shoreline fluctuations remain relatively stable for the duration of the project design life. However, nourishment material is dynamic by nature, will be affected by large storm events and changing water levels, and will require periodic maintenance.

The City will perform a citywide beach stabilization study of how beaches may respond to sea level changes to inform sound engineering and a cost-effective approach to planning for a future nourishment schedule. Several scenarios will be considered in the modeling including volumes of sand, material placement, and the addition of hard engineering structures (e.g., groins and breakwaters) to promote the accumulation and longevity of placed sand. The goal of evaluating multiple scenarios is to determine an effective method in dealing with spatial alongshore variation and high erosion or deposition that routinely occurs in nourished beaches.

**Implementation Steps:**

- Establish partnerships to cooperatively complete the stabilization study for regional beaches.

**Potential Cost Level:** Low, Medium, High

**Equity Impacts:**

- Increased beach stability represents recreational opportunities and relief during extreme heat days for residents throughout the City including those most vulnerable to extreme heat impacts

DRAFT



**FLD-07: Conduct studies of combined riverine/coastal flooding and increased precipitation impacts on watershed flooding**

Carry out further studies to understand the potential influence of sea level rise and increased precipitation on flood risk at the riverine/coastal interface and along river channels.

**Lead:** Public Works, U.S. Army Corps of Engineers, County of Los Angeles

**Partners:** Other municipalities within the Los Angeles River Watershed and San Gabriel River Watershed

**Timeline:** Short

**Potential Performance Metrics:**

- Completed study(ies)

**Co-benefits:**

- Redevelopment of channels could provide recreation, open space, and/or habitat, and benefit disadvantaged communities in West and North Long Beach

**Description:**

While existing 100-year floods occurring along the primary riverine waterways in Long Beach are contained within their channels by existing levees, overtopping risk could be exacerbated in the future by a combination of sea level rise and increased intensity of precipitation. With more intense precipitation events projected as a result of climate change, increased peak flows into major drainage channels (the Los Angeles River, Los Cerritos Channel, and the San Gabriel River) could cause overtopping of levees that were previously adequate. In addition, as sea levels increase, the zone of tidal influence will move further up the channels. If a major precipitation event coincides with a high tide, flood waters will not be able to discharge the channels as quickly, possibly resulting in overtopping at the riverine/coastal interface.

Reliable modeling on how riverine floodplains will be impacted by changes in extreme precipitation patterns and sea level rise does not exist for Long Beach. For this CAAP, asset exposure to riverine flooding was assessed based on location within the Federal Emergency Management Agency's (FEMA) 100- and 500-year riverine floodplains. Given the large spatial extent of the existing 500-year floodplain, the area within the 100-year floodplain could increase considerably in the future as climate conditions evolve.

The City will carry out or partner on one or more studies that contain the following analysis. Hydrologic and hydraulic analysis of watersheds and drainages that flow through Long Beach, accounting for future projected changes in precipitation and sea level rise, will produce a more detailed understanding of future riverine flooding vulnerabilities. Analysis of urban flooding variables will be factored into this analysis such as condition of stormwater infrastructure and the extent to which its characteristics exacerbate or mitigate flooding. A combined riverine/coastal flooding analysis will be conducted to assess the potential impacts flooding at the riverine/coastal interface will have on the surrounding neighborhoods and infrastructure. Similarly, a study of the impacts of increased precipitation on watershed flooding will be

used to understand how future flood conditions could increase flooding along river channels and in urban neighborhoods and inform prioritized locations and timelines for elevating levees (RIV-08).

**Implementation Steps:**

- Perform study of combined riverine/coastal flooding to understand how flooding at the riverine/coastal interface will impact surrounding neighborhoods and infrastructure and review. Integrate consideration of urban flooding variables into the study to understand combined impacts
- Perform study of the impacts of increased precipitation on watershed flooding to understand how future flood conditions could increase flooding along river channels
- Based on these studies, prioritize the locations and timelines for elevating levees (RIV-08) and other adaptive strategies, such as watershed restoration or green infrastructure to reduce flood impacts

**Potential Cost Level:** TBD

**Equity Impacts:**

- This action could address flooding in neighborhoods socially vulnerable to climate change along the three major river channels, as identified in the Long Beach Social Vulnerability to Climate Change Map (<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7150>)
- Creatively re-developing the channels could concurrently provide new recreational benefits to low-income residents, as is envisioned in plans for the upper LA River
- Potential for improved access to funding for investment in low-income and disadvantaged communities

**FLD-08: Restore dunes**

Convert seasonal storm berms to year-round dunes through active dune restoration. Discontinue beach grooming and plant native dune species to allow natural vegetation to stabilize dunes and hold sand.

**Lead:** Parks, Recreation, and Marine

**Partners:** Public Works

**Timeline:** Short

**Potential Performance Metrics:**

- Linear feet of dunes restored

**Co-benefits:**

- Restoration of dunes may provide habitat benefits
- Discontinuing beach grooming will decrease disruption to beach habitat and species
- Reduced City expenditure over time on annual sand berm engineering

**Description:**

The communities of Belmont Shore and Alamitos Peninsula are vulnerable to flooding from a 100-year storm surge after 11" of sea level rise, and to flooding from a king tide after 24" of sea level rise. Both areas are fronted by coastal beaches, which could provide improved protection from storm surges if strategies are implemented to support the growth of sand dunes as a buffer.

Sand dunes are formed naturally when sand or sediment blown by wind accumulates against an obstacle, generally vegetation. Healthy dune systems rely on the root systems of dune grasses and other vegetation to maintain their shape. Currently, the City of Long Beach operates a beach grooming program along Belmont Shore Beach. While grooming helps maintain the pristine appearance of the beach, flattening the sand each day prevents dunes from forming naturally, and clearing the buildup of seaweed deprives beach vegetation of an important source of nutrients.

Due to the lack of natural dunes, the City currently engineers sand berms each year to provide protection for adjacent communities from seasonal swells. However, because these berms do not have vegetation holding them together, they are eroded by tides and wave action each year and need to be replaced.

By implementing a comprehensive active dune restoration program, the City will enable the regrowth of sand dunes as natural coastal protection along beaches that do not have a bluff behind them. Dune restoration activities will include planting native beach vegetation and discontinuing beach grooming for along the landside portion of each beach. Because residents of Long Beach have come to expect the beaches to be devoid of vegetation, educational signage will be necessary to communicate the purposes and advantages of dune restoration.

**Implementation Steps:**

- Implement active dune restoration strategies, including the planting of native beach vegetation and building of wooden fences to help retain sand
- Discontinue beach grooming to allow dunes and dune vegetation to form
- Protect dune restoration areas using fences and build dune crossovers for beach access
- Develop public messaging materials and signage to communicate purpose of dune restoration

**Potential Cost Level:** TBD

**Equity Impacts:**

None identified

### **FLD-09: Inventory and flood-proof vulnerable sewer pump stations**

Assess potential for flood damage at all sewer pump stations, and for pump stations identified as vulnerable to flooding, apply flood-proofing techniques and add emergency generators.

**Lead:** Public Works

**Partners:** Long Beach Water, Parks, Recreation, and Marinet, Disaster Preparedness and Emergency Communications

**Timeline:** Short

#### **Potential Performance Metrics:**

- Completed inventory prioritized by highest vulnerability
- # of retrofitted sewer pump stations

#### **Co-benefits:**

- Protects water quality by preventing failure of sewer pump stations, which could have serious environmental and public health consequences

#### **Description:**

One of the City's priorities in the coming years will be hardening its wastewater infrastructure to increase the system's resilience to flood damage. Many of the City's pump stations are located in or near areas at risk of flood exposure and power outages. Pump stations rely on an uninterrupted power supply to maintain operation and power failure may cause sewage overflows and backups may result. Because the likelihood of flooding will increase over time with sea level rise, the City will implement protective measures through capital projects to reduce flood damage for pump stations identified as vulnerable to future flood conditions.

As an initial step, the City will perform a detailed inventory of all pump stations identified as vulnerable to future flooding. The inventory will include updated information for critical electrical and mechanical components (e.g., elevation, condition, age, etc.) and entryway elevations that could serve as a flood pathway.

Flood adaptation strategies are likely to vary for each pump station depending on local conditions (e.g., space constraints, cost-effectiveness, station criticality, projected flood depth, etc.). Potential flood-proofing strategies may include the following: elevating pump housing entryways, sealing the building and entryways to projected flood depth, elevating electrical equipment, or replacing existing pump with a submersible pump. All vulnerable pump stations should also be equipped with a flood-proof backup generator to maintain operability even during storm-induced power outages. If flood-proofing techniques are not possible due to the configuration or location of components, the entire pump station may need to be relocated.

**Implementation Steps:**

- Assess potential for flood damage and timing of vulnerability for each sewer pump station
- For pump stations identified as vulnerable, apply flood-proofing techniques, elevate, or relocate as necessary
- Equip all vulnerable pump stations with a flood-proof backup generator to ensure continued operation during power outages

**Potential Cost Level:** TBD

**Equity Impacts:**

### **FLD-10: Investigate sea level rise adaptation funding mechanisms and strategies**

Explore a special flood district or alternative funding strategies to help pay for improvements in flood prone areas.

**Lead:** Planning and Building, Public Works, City Manager, Financial Management, City Auditor

**Partners:** None identified

**Timeline:** Medium

#### **Potential Performance Metrics:**

- Completed study

#### **Co-benefits:**

- Potential preservation/enhancement of public coastal access and recreational resources
- Potential for improved water quality from reduced stormwater runoff
- Job creation and economic development

#### **Description:**

The physical infrastructure required to protect coastal regions of Long Beach from sea level rise will be costly and require creative financing strategies and partnerships in order to be successfully implemented. There are a variety of financing options available to generate revenues to pay for maintenance, repair, rehabilitation, and improvements to reduce flood risk. This could include the establishment of a flood assessment district or establishing taxes or fees.

Special districts are local government entities created to offer specific public services, such as flood protection, within a defined area. The City could delineate special flood protection districts based on the regions protected from flooding by proposed adaptation projects. A special flood district could levy a shoreline tax on property owners within the special district to pay for protective infrastructure based on property value. A special flood district could also levee an assessment to raise money for adaptive infrastructure directly from property owners that would be protected by the project. The assessment paid by each property owner within the special flood district would be based on avoided damages to their property.

While residents may be initially adverse to additional fees and taxes, the City can generate support for these strategies by communicating that the cost of inaction is significantly higher. A special flood district tax requires approval by 2/3 of property owners within the district while an assessment requires approval from a majority of property owners within the district, weighted proportionally by the assessment each owner would pay. However, for assessments, the district must quantify the avoided damages to attribute to each property in order to determine the proportion of the assessment each property owner should pay. Other funding mechanisms such as an increase in Transient Occupancy Taxes have been established in other cities and dedicated to shoreline adaptation strategies.

The City will conduct an evaluation of the feasibility of the range of different options available at the time the study is initiated. Because this is a medium-term action it is likely that the range of options available to fund shoreline adaptation will expand as regional, state, and federal agencies establish more policy options in response to increased impacts of rising sea levels and related impacts.

**Implementation Steps:**

- Conduct a comprehensive study to assess the political and financial feasibility of different funding mechanisms that includes a process to engage potentially impacted stakeholders

**Potential Cost Level:** TBD

**Equity Impacts:**

- Coastal regions of Long Beach that will be at risk from sea level rise are generally more affluent areas. Raising money for adaptive infrastructure from landowners, rather than relying solely on municipal funds, will avoid tax revenue from lower income areas subsidizing protection for more affluent residents.



**FLD-11: Relocate/Elevate critical infrastructure**

Raise or relocate critical infrastructure to be outside the sea level rise vulnerability zone.

**Lead:** Public Works, Financial Management

**Partners:** Fire Department, Police Department, Long Beach Unified School District, Health and Human Services, local hospitals

**Timeline:** Medium

**Potential Performance Metrics:**

- % of facilities/infrastructure identified for retrofit/relocation and timeframe
- % of facilities/infrastructure retrofitted/relocated in identified timeframe
- # of facilities with continuity plan to maintain operations

**Co-benefits:**

- Uninterrupted critical services during storm events

**Description:**

Critical infrastructure refers to essential assets and services for the economy, society, and health of the public. This includes buildings, such as fire stations, hospitals, schools, police stations, and key government facilities, as well as critical components of transportation, wastewater, potable water, and energy distribution systems. To maintain operational continuity during or immediately following flood events, the City is prioritizing adaptation of critical facilities. The City will use the sea level rise inundation maps prepared as part of this CAAP, as well as subsequent studies on urban/riverine flooding recommended by the CAAP, to assess each facility's exposure to flooding, including the expected timing of flood risk. For exposed assets, the City will assess the vulnerability and value of critical infrastructure as a way to inform decisions regarding applicable approaches to adaptation. Whenever possible, the City will prioritize relocation of critical infrastructure and services to a less vulnerable area. As an alternative, the City may retrofit existing infrastructure facilities to reduce the risk of flood impacts. Examples of retrofits include: elevate and protect electrical control systems, elevate access routes, installation of a flood-proofed power generator, interventions to protect underground utilities and telecommunications from water damage, backflow prevention for building, and flood-proof building entries that may become a flood pathway.

For example, a facility (e.g., police or fire station) that needs to remain in operation during or immediately following a flood event may be flood-proofed using a permanent barrier. A facility (e.g., hospital) that needs to recover quickly after a flood event may elevate electrical or necessary equipment and have deployable barriers. In cases where it is not feasible to relocate critical facilities outside of the flood vulnerability area, the City will prioritize regrading facility access roads to be above the projected flood elevation. As an added precaution, all critical facilities located in areas vulnerable to future flooding will

be required to complete a continuity plan that describes appropriate design interventions necessary to maintain operation during or after flood events.

**Implementation Steps:**

- Perform an asset-level vulnerability assessment for each critical facility
- For facilities identified as vulnerable, recommend flood-proofing techniques, raising, or relocating as necessary
- Prioritize implementation of upgrades based on expected timing of inundation

**Potential Cost Level:** TBD

**Equity Impacts:**

- Protection of access to city services and facilities in neighborhoods that are vulnerable to sea level rise and riverine flooding

**FLD-12: Elevate riverine levees**

Based on results of riverine flood study (RIV-02), elevate channel banks and levees to provide enhanced flood protection.

**Lead:** Public Works, U.S. Army Corps of Engineers

**Partners:** Los Angeles County, Port of Long Beach, Port of Los Angeles, Los Angeles County Flood Control District, Long Beach County Flood Control District, California Coastal Commission, California State Lands Commission, U.S. Fish and Wildlife Service

**Timeline:** Medium Term

**Potential Performance Metrics:**

- List of prioritized levees and timing for adaptation strategies
- # of priority projects implemented/completed

**Co-benefits:**

- Redevelopment of channels could provide recreation, open space, and/or habitat

**Description:**

Based on the results of FLD-07 (Conducts studies of combined riverine/coastal flooding and increased precipitation impacts on watershed flooding), portions of the existing levees adjacent to the City's channels and rivers (Los Angeles River, Los Cerritos Channel, and San Gabriel River) may be elevated or modified to provide enhanced flood protection. If feasible, the levees will be designed for multipurpose use to provide opportunities for open space integrated with commercial and residential development. Multi-purpose infrastructure can also improve the urban ecosystem and enhance living conditions for local communities. Complementary riverine modification projects may also include channel widening or watershed restoration, which would likely further enhance habitats and recreation co-benefits.

As flood protection structures along the major river channels are owned and managed by an array of public entities, including the U.S. Army Corps of Engineers, Los Angeles County, and others, modification projects will require a high degree of interagency and regulatory coordination. Therefore, design and permitting should begin well before overtopping is expected to occur.

Implementation of channel modification projects should be prioritized based on an assessment of the consequences and likely timing of flooding at each portion that is at risk. Consequences assessed should include the number of residents and businesses, as well as critical facilities and transportation assets within each flood path.

**Implementation Steps:**

- Based on riverine flooding studies performed in action RIV-02, identify portions of major river channels at risk of overtopping

- Prioritize at-risk portions of channel levees based on timing of potential flooding
- Perform interactive design process to seek input from stakeholders on design alternatives
- Implement channel modification projects with owners of flood control structures and project leads
- Seek creative funding options prioritize investments in communities with limited access to greenspace

**Potential Cost Level:** TBD

**Equity Impacts:**

- This action could address flooding in neighborhoods socially vulnerable to climate change along the three major river channels, as identified in the Long Beach Social Vulnerability to Climate Change Map (<http://www.lbds.info/civica/filebank/blobdload.asp?BlobID=7150>) Creatively re-developing the channels could concurrently provide new recreational benefits and access to green space to low-income residents and disadvantaged communities, as is envisioned in plans for the upper Los Angeles River

## Long-term Flooding Adaptation Actions

Table XX describes potential long-term actions (between 2050 and 2100) the City could implement to increase flood resilience through the end of the century. No governance actions were identified, but several studies regarding the feasibility of managed retreat and a storm surge barrier were included as potential informational actions to increase flood protection for the region. A suite of long-term structural actions were also identified and include approaches for elevating the shoreline, and raising or relocating infrastructure currently placed in areas vulnerable to future flood exposure. Figures XX and XX show the location of the described potential infrastructure strategies.

### Long-term adaptation actions for sea level rise and riverine flooding

Action Number	Action Title	Action Description (1-2 sentences)	Specific Location (where applicable)	Potential co-benefits	Equity Impacts
<b>STRUCTURAL/PHYSICAL (see Figure x and x below)</b>					
FLD-13	Continue to nourish beaches	Based on findings from beach stabilization study, beaches identified as suitable could be nourished so that they are elevated and preserved	Bay View Beach and Peninsula Beach	Increased tourism	Beaches serve as recreational opportunities for inland residents and disadvantaged community members, particularly on hot days. If climate change exacerbates heat in Long Beach, beach access will become an even more valuable resource for inner city residents
FLD-14	Construct living shoreline/berm	The shoreline could be elevated to tie in with the landscape and park facilities to prevent flooding of inland areas while continuing to provide beach access	Mothers Beach	Mothers Beach is used heavily on the weekdays and weekends by city residents and visitors for swimming, dragon boat races, picnicking, and other forms of recreation. Protecting this park and beach will protect other areas in Naples from flooding and also preserve the park	Mothers Beach provides residents park and beach access, particularly on hot days and could become an even more important resource as climate change exacerbates heat in Long Beach
FLD-15	Elevate/extend curb	The curb could be elevated and extended to eliminate gaps that could become flood pathways	Bay Shore Drive in Alamitos Bay	Long-term preservation of access to restaurants, shops, and the library on 2 <sup>nd</sup> St. Elevating the curb may also provide flood protection for additional inland assets	The businesses along 2 <sup>nd</sup> Ave serve many residents

Action Number	Action Title	Action Description (1-2 sentences)	Specific Location (where applicable)	Potential co-benefits	Equity Impacts
FLD-16	Elevate streets/pathways	Elevate waterfront streets and paths to provide protected transportation routes and flood protection for infrastructure behind the road/path	Communities adjacent to Alamitos Bay, including Belmont Shore, Naples, and Marina Pacifica	Could also be combined with drainage improvements to reduce flooding associated with heavy rainfall	This action would protect schools and the fire department, which provide critical services for the region
FLD-17	Retrofit/extend walls	The existing wall may currently provide some flood protection, but it is segmented and not designed for flood protection. It could be retrofitted or rebuilt to provide adequate protection against SLR	E. Paoli Way near the Marine Stadium	The Marine Stadium and E. Paoli Way are a flood pathway for flooding and inundation under future SLR. Upgrading the wall here would protect Apian Way (a major connecting road) and several inland neighborhoods	Residents use Apian Way to access the beach areas and visit the Belmont Shore neighborhood. Protecting these areas will preserve access
FLD-18	Retreat / realign parking lots	Relocate, reduce size, or realign parking lots as beach narrows	Beachfront parking lots	Action would protect parking lots from erosion and less habitat impacts of beach narrowing	
FLD-19	Extend/upgrade existing seawalls	Sheet pile seawalls could be expanded to other areas of the Naples shoreline that are not being addressed by the current upgrade	Treasure Island, areas to the east near the Yacht Club, and areas to the north (which could also be protected by a berm if space allows)	Long-term preservation of access to local public beaches and businesses	
<b>INFORMATIONAL</b>					
FLD-20	Investigate feasibility of managed retreat	Explore managed retreat options for vulnerable shoreline infrastructure through land acquisition and relocation programs	Communities adjacent to Alamitos Bay, including Belmont Shore, Naples, and Marina Pacifica	Managed retreat may create more space for flood events and alleviate flood conditions to adjacent properties	
FLD-21	Evaluate feasibility of storm surge barrier at Alamitos Bay	Conduct a feasibility study to evaluate construction of a storm surge / tide gate barrier at entrance to Alamitos Bay	Alamitos Bay		Action would protect all inland areas along Alamitos Bay shoreline from storm surge flooding
<b>GOVERNANCE</b>					

Action Number	Action Title	Action Description (1-2 sentences)	Specific Location (where applicable)	Potential co-benefits	Equity Impacts
No long-term governance actions					

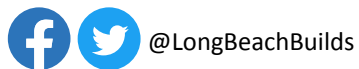


Locations of potential long-term flood protection actions





Locations of potential long-term flood protection actions in Alamos Bay area



This information is available in alternative format by request at (562) 570-3807.  
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